SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

COAL MINING IN NORTH WALES.

There are scarcely any of our colliery districts where there are so many, and such valuable, seams of coal as are to be found in Flintshire and Denbighshire; and although the production is not very large—about 2,500,000 tons per annum—yet the collieries generally are tolerably profitable, whilst there is a large field awaiting development. In Flintshire there are some 15 or 16 seams, in some places being upwards of 60 ft. thick, including the rich plain and curley cannel, containing large quantities of oil, and a variety of steam and household coals. Several of the collieries are worked below the River Dee, under the bed of which there is a supply, at the present rate of raising, calculated to last upwards of 300 years. In the neighbourhood of Ruabon are several large collieries, doing a very good business; whilst in the neighbourhood of Mold, at Leesewood, Coppa, and some other places, a very fine cannel, a good deal of which is taken by several works for oil-extracting, is raised.

At Mostyn Colliery, a short distance from Holywell, nearly 400 men are employed, and several seams of coal are being worked, including the Five Yard. There has been a dispute recently at the place, the workmen having made a demand for an increase of wages. Nearly 80,000 tons of coal are raised per annum, whilst, singular to say, the coal in part of the pit has been on fire for nearly a year, and owing to the extensive area of workings it has not been put out, although all communication is cut off as much as possible with it. At the adjoining colliery, the Hanmer, a very good business is being done, the Five-Yard seam being worked, and about 40,000 tons of coal being annually raised.

Near to Flint, the Flint Marsh Colliery is now doing a very fair business, working the Five-Yard and Three-Yard beds, raising about 80,000 tons a year. A branch line on to the Chester and Holyhead line has just been completed, affording additional facilities for the transport of the produce. At the Tyddyn Ucha pit, near Holywell, a favourable trade is being done, there being a good land sale.

Near to Hawarden is the Aston Hall Colliery, the lessor of the coal being now the present Prime Minister, having recently purchased the estate formerly belonging to the Dundas family. In connection with the pits are large brick and tile works, a very fine bed of clay being found in connection with the coal. Up to the present the collieries and works have cost the present company about 70,000*l.*, without as yet giving any return. They are now working the Five-Foot and Three-Foot seams. The former has only just been found, and, in honour of the lessor, has been called the "Premier seam." The workmen are now driving out the roads and levels, and when they are completed two 24-inch cylinder horizontal engines will be put down for drawing. The rough coal and the Holling seam are not just now being worked. As the steam coal recently found at Hawarden has been tested lately, and found to be of a very good quality, with a view of it and the coal of a similar quality in North Wales being put on the Admiralty list, the attention of Mr. Gladstone was called to the subject, seeing he was himself to no small extent interested in it. Mr. Gladstone, however, stated that he could not entertain any suggestion whatever, or take any part in getting the coal placed on the list, and for the very reason that he was really an interested party. An application was made to the Admiralty to have the coal tested, with a view to have it put on the list, but this was refused; still, hopes are entertained that the steam coal of North Wales will yet be placed in the same position as that of the southern part of the Principality.

In the neighbourhood of Queensferry there are now several collieries doing a good business. Amongst them that of the Prestatyn Coal Company is working very well, the men being engaged in driving out in the Four-feet and Yard coal. Not far from the pits is a shipping place known as Connahs Quay, from which a good deal of coal is sent to Dublin and other places from the Oaks, and also from some of the pits in the Buckley district, to which there is a line of railway. Between the quay and Flint a series of borings to the coal measures for Mr. Hunter have recently taken place, and it is expected that the district will be opened out before long.

Most of the collieries in the Buckley district are kept well going. The Little Mountain sending both by rail and water. Mr. Lassey, of Halifax, and another gentlemen, have taken to the Buckley Colliery, and are making considerable alterations and improvements. Some new plant has been put down, and cages have superseded the old-fashioned, and by no means pleasant, "baskets," which are still to be found in the district. The pit is now a really good concern, and the main seam of coal is being worked, so that the prospects of Mr. Lassey and his partner are in everyway encouraging. The other pits in the same locality are moderately well off for business.

In the Mold district there are several large collieries, at most of which there appears to be tolerable activity. At Bronfield Hall an average trade is being done, whilst at Bronwhylfa there is scarcely so much going in the direction of Birkenhead, from which the shipments of coal have not been so large lately as usual. The Oak pits are working very fairly now, and the men fully employed.

The Argoed Hall Company are about to put down the "Bull" engine for pumping, which was bought a short time since at the sale of the plant of the Westminster Mine. Work was stopped, owing to an influx of water whilst sinking, and before the coal was reached. The engine will shortly be at work in clearing, so that active operations will be resumed.

Pumping is still being proceeded with at the pit of the Pantre Coal Company, and it is expected that the men will shortly commence driving out.

The pneumatic sinking at Bagilt proceeds very slowly, and up to the present time something like 27 or 28 yards only have been sunk, the water having interfered with the ordinary operations. The outlay so far, for the distance gone, has been very large, but as the seams of coal are good, one of them 15 feet thick, there is but little doubt that once the coal is reached a good profit will be realised, and the proprietors recouped the large expenditure rendered necessary by the peculiarity of the strata gone through, and the water which has been encountered. The principal shaft, we believe, will be about the largest in the kingdom, and the seams of coal the same as those being raised at the Mostyn and Hanmer Collieries, and all of which are situate quite close to the banks of the River Dee, so that there are excellent facilities for transport by rail and water. At Wrexham, where the 15-ft. seam is also worked, business continues fair at most of the places.

Several of the oil works, which are very good customers for the Cannel coal, are doing very well just now, whilst one or two new works have recently commenced working. There is not so much activity at the various iron establishments, most of them depending on the lead and coal mines for orders. A better state of things, however, is anticipated, as mining operations will be greatly extended as the weather becomes more suitable and settled.

ON THE WARWICKSHIRE COAL FIELD.

This coal field extends from the east of Tamworth to Wykin, about three miles north-east of Coventry, a length of fourteen miles, its breadth may be assumed at three miles, equal forty-two square miles, as the proved portion of a probably much larger field. The continuation of the coal field westward until it joins the South Staffordshire coal field may reasonably be calculated on, as many of the pits are not only sunk through the Permian formation, but have extended their operations further under that formation as far as 1200 yards. There are many points of resemblance in the two coal fields which point to this conclusion. The accumulation of layers of coal in the Warwickshire mines, known as the Two-yard, Rider, Ell coal, and Slate coal, giving an arregate thickness of coal, and thin bands of shale and clod of about 27 feet, as worked in the collieries at the southern end, these layers may be taken to be the representatives of the Thick coal of South Staffordshire; both are of the non-coking quality, and there is the same tendency to spontaneous combustion in each; there is, however, more inferior coal and impurities in the Warwickshire side than in the South Staffordshire. The area of the unproved part—under the Permian formation—may be taken at 112 square miles. As the workings of the existing collieries—dipping at first about 12 inches per yard—have at the extremities become nearly level, the depth to sink anew to the coals will not be an unattainable object when these coals are required. There are at present sixteen collieries in Warwickshire; these produced in 1868 about 625,000 tons of coal and 15,000 tons of ironstone. Most of the coal is sold in the district a round as house fuel; it is adapted also for manufacturing purposes, but is not in extensive demand on that account. It is stated that the coal is too tender for iron smelting. As ironstone is abundantly deposited be low the workable coals, the question of the establishment of blast-furnaces has been raised for smelting it on the spot, but it may well be doubted whether the manufacture of pig-iron would be remunerative, if coke has to be imported from a distance, and the native ironstone is costly in obtaining. The black ironstone yields as high as 50 per cent. of iron, but it is sparingly deposited in the ground. It is sold at 13s. per ton at the pits, and is sent principally to the South Staffordshire district. The white ironstone contains a much smaller percentage of iron.

Wykin Colliery.—This is situated at the southern end of the coal field, and is one of the most extensive in the district, possessing powerful engines for raising coal and for pumping water. The coal seams east of the present pits have been worked in former times up to the basset; these workings are to a great extent heavily pounded with water; it is found necessary to pump this water in order to protect the existing colliery. The water is pumped at two points, at the high level and at the low level pits. At the high level one engine is erected; the water pit is 140 yards in depth; the cylinder is 58 in. in diameter, 7-ft. stroke, condensing, the beam extending to the pit, as in the Cornish engine. The top set is forcing 14½-in., the second and third are bucket lifts 15 inches in diameter. There are three plain boilers, 32 by 5½ ft. This engine goes five strokes per minute, day and night, and pumps water which would otherwise run to the low level engines. There are three water pits at the low level, and two pumping beam-engines. The Tom-engine has a 66½-inch cylinder, 7 ft. 9 in. stroke, condensing. It raises water from the depth of 235 yards in five lifts in two pits outside the house, having a counter beam working between them, to one end of which the engine connecting-rod is attached. The pit next to the house is 100 yards deep, and contains the two upper lifts, each 15½ in. in diameter; at the opposite end of the counter beam the three lower lifts are placed in the pit 235 yards deep; the buckets vary from 12 to 12½ in. in diameter. The pump-rods are all iron, 3 in. square, both in and outside the pumps. The Godiva engine has a 63½-inch cylinder, 7-ft. stroke, single-acting, condensing, for the other water pit (near those just named). The pit is 235 yards deep, and contains four lifting sets, the lowest being 8 in., the next above 10 in., and the two upper ones 15½ in. in diameter. The pump-rods are of wood, all proceeding from the yoke at the end of the beam. This yoke runs vertically in guides at the top of the pit. The Tom-engine is kept going generally day and night, at the rate of five strokes per minute, the other engine being kept in reserve during any stoppage of the former. There are four balloon boilers for both engines; pressure of steam, 5 lbs.; four yards of cast-iron tubbing is stated to be fixed in these pits.

The Wykin coal pits, two, are 10 ft. in diameter, 40 yards apart, 250 yards deep, being sunk through about 60 yards of drift and Permian strata at the top; there are over 30 yards of cast-iron tubbing in the Permian strata; the pits are walled with bricks and mortar below that. The downcast pit is fitted with wood conductors for the two cages, each cage holding two tubs on two decks. The winding-engine at the downcast pit has one 34-inch vertical cylinder, 5-ft. stroke, direct-acting, non-condensing. It is fitted with guide-blocks at the end of the piston-rod, double seat valves, and two eccentrics; 11 ft. rolls for flat wire-rope. The engine was built in 1863; it raises about 300 tons of coal per day. The winding-engine at the upcast pit has two 14-in. horizontal cylinders, 2-ft. stroke, pinion and spur-wheels 1½ and 4½ ft. in diameter. One drum 9 ft. for round wire-ropes. The two cages in the upcast run each on three wire-rope guides, and carry one tub; about 150 tons per day are raised here. There are 11 boilers, 28 by 4½ ft., in one range; steam 50 lbs. pressure to supply the winding-engines, and a hauling-engine underground; the steam for the latter is taken down the upcast in pipes, and the escape steam is brought up the pit several yards in pipes.

The pits are sunk 20 yards below the coal, in order to have a level of 60 yards for a bank-head. The bank-head commences about six yards south of the downcast pit, and proceeds west. One engine plane goes in the same direction about 480 yards, being the full dip, about 12 inches per yard at first, becomes flatter near the bottom. The other branching off at the bank-head goes north-west 480 yards, and dips about 8 or 9 inches per yard at first, it becomes lighter lower down. The engine is placed in a recess in line with the bank-head. One horizontal 20-inch cylinder, 4½ feet stroke, pinion and spur wheels 1 to 4. Two 10-ft. drums, 1¼-in. iron ropes. While the engine draws the tubs up one plane by one drum, the second drum is loose, and the tubs are run down the other plane, and *vice versa*.

Though the coal altogether is reckoned as three seams, it is in reality but one seam, as follows:—

1.—The Rider	Clod			0 ft.	10 in.
	Coal, third	1 ft.	3 in.		
	Stone	0	10	thrown back	
	Spires, third	0	10		
	Coal, third	1	6=	4	5
	Parting			0	1
2.—Ell Coal	Tops, second	2	0		
	Middles, third	1	6		
	Spires, first	0	10		
	Black coal, third	1	0=	5	4
	Lam or clod			3	0
3.—Slate coal	Roof coal	2	0	left for roof	
	Slate coal, first	5	0		
	Lady coal, thrown back	1	6=	8	6
	Total			21	4

This remarkable deposit of coal is worked in a no less remarkable manner. The bottom part, the slate coal, is first worked on the long wall principle to the rise, the vacancy behind being filled with the refuse. The middle, or Ell coal, is worked in the same manner, about 20 yards behind the slate coal. The rider is worked similarly, about 20 yards behind the Ell coal. The face of work in each division is about 300 yards in length, northward from the engine-planes in one line, and about 200 yards in length southward, or 500 yards altogether. There are communications from one face of work to another, across the measures, every 100 yards, for convenience of bringing out the coal. This is done by ponies; there are 21 ponies employed in the mine, each brings out a tub at once, along the face of work, and through the cross places.

It should be observed it is the general practice in the mines of Warwickshire to drive to the dip to the boundary, and then work the coal by long wall up the bank to the pits, hauling being effected up the bank by engine-power. If the coal were worked to the rise of the pits, it is understood the gob roads could not be maintained in order to bring out the mineral. In the Wykin Mine, the engine-planes I have described were driven 300 yards below the present termination of the engine-plane, or about 780 yards down, when the long wall working was commenced, and the coal taken away up hill, in three stages, as described, and about 500 yards in width. It has now been worked up hill about 300 yards. The effect of this mode of working is to break the upper coals very much, and produce a large amount of small, but all the coal of any value seems to be obtained, as well as variety in quality produced. The coal is separated into first, second, and third qualities, either in the pit or on the bank, as shown on the section; and the riddlings, 1½ inch mesh, produce cobbles and slack. The circulation of air in the mine is effected by the escape steam from the underground engine; very little gas is thrown off from the coal. As a rule, the coal comes down of itself, after being holed, without the use of gunpowder. The coal tubs are of wood, carrying about 6 cwts., with 9-in. flanged-wheels, running on a gauge of 20 inches.

The Wykin Coal Company have a branch railway of 1½ mile, to join the Coventry and Nuneaton Railway. They can also send their coal by the Oxford Canal to the south and east districts. The coal being used almost exclusively for house purposes, the demand is somewhat fluctuating, according to the season. They have a large land-sale demand during the winter months for Coventry and the neighbourhood.

At Victoria Colliery (adjoining to Wykin) the same seams are worked as described at Wykin, also the 2-yard coal, which lies immediately above the rider, a parting of 2 or 3 in. only between them. The 2-yard coal averages 5 ft. thick, and surpasses the other seams in its quality and suitability for house purposes. There are two pits at Victoria—one downcast and one upcast. The coal is won by working to the dip. The engine plane is about 600 yards in length. The engine for hauling the coal up the plane has a 14-in. horizontal cylinder. The steam is taken down the upcast from the boilers at the surface; it also pumps water from the dip, for which pipes are laid. The escape steam from this engine, as well as a furnace at the bottom of the upcast, produces the circulation of air for the mine. The total thickness of coal worked is increased by the addition of the 2-yard coal, consequently the system of working includes four stages of long wall work following one after the other, at regular intervals. Unfortunately, a fire took place in this mine on or about the 10th inst., caused by spontaneous combustion; the working of the colliery is suspended in consequence. The most of the coals in this district are subject to fire from spontaneous combustion, the rider coal more particularly. In this instance stoppings have been placed in the passages near the top of the slope, so as to exclude the air entirely from reaching the interior part. A beam winding-engine placed between the pits at the surface for raising the minerals also draws water at nights by tanks.

At Hawkesbury Colliery, a pumping-engine of 60-in. cylinder, 6-ft. stroke, with beam extending over the pit, is kept going day and night. There are two coal pits here, downcast 245 yards deep. One 30-in. cylinder horizontal-engine, 5-ft. stroke, direct acting; 12-ft. plain drum for round ropes. The winding-engine at the upcast is a 24-in. horizontal-cylinder, 4½-ft. stroke, direct acting, 10-ft. drum; depth of upcast 150 yards. There are two engines placed underground for hauling up from the dip, one 25-in. horizontal-cylinder, 5-ft. stroke, on second motion, and one 18-in. horizontal-cylinder, 4-ft. stroke, on second motion. Endless chains have been introduced here on both the engine-planes, but they are not approved of for the banks, they are retained in the level part only at the top. Water is pumped by one of the engines, in three lifts, pipes being laid down in one of the planes. The 2-yard, Rider, Ell coal, and Slate coal, are found and worked here, as at Victoria. The steam for the engines is taken from the boilers at the surface. Ventilation for the mine is caused by a furnace and the escape steam from the engines. The 7-ft. seam is found 13 yards below the Slate coal, and averages 5 ft. in thickness. Below this the measures have been proved 56 yards, and seams of coal, varying from 1 to 3 ft. in thickness found, and several beds of ironstone None of these coals are yet worked; they will, no doubt, come into operation as the upper seams become exhausted. The white ironstone and the black ironstone, two important beds, are both worked at Hawkesbury.

The Bedworth Charity Colliery is understood to be driven

1200 yards to the dip of the pits; the coal is drawn up by engine-power. The same seams of coal are got as at Hawkesbury, and ironstone also is extensively worked.

EXHALL NEW PITS have just reached the 2-yard and adjacent seams; the lessee of this property being Mr. E. Wilson. The GRIFF COLLIERY—Mr. C. Newdegate's—is also in operation on the same seams of coal. The whole of these pits are sunk through the Permian formation, which is very variable in thickness, and does not lie conformably on the coal measures.

THE NEW LINE OF RAILWAY UNITING NORTH STAFFORDSHIRE AND NORTH SHROPSHIRE.

This additional link of communication between these two counties promises to be some importance. The new line may really be said to be an extension of the North Staffordshire Railway from Stoke through Newcastle and Silverdale to Market Drayton, a distance of 12½ miles. It unites a rich mineral district of one county with another purely agricultural, and thereby open up a direct communication for the Staffordshire Potteries by means of the Great Western, with the West and South of England. Silverdale is a westerly extension of a mining district clustered round by hundreds of manufactories and work of various kinds, with population requiring the farming produce of Madeley and Market Drayton, the facilities for placing which within ready reach will be now very much increased, at the same time that the further development of the deep rich mines to which Silverdale is indebted for its prosperity will be aided much by this inlet and means of intercommunication.

Formerly, Silverdale was what its name implies, a pleasing pastural undulating vale, with green fields through which meandered a pure, cheerful stream; and now, Nature still struggling to keep a footing on hill and valley side, it presents a few full-foliaged trees in summer, whilst patches of greensward here and there flourish where sulphurous gases permit, but the stream along the vale is transformed by the thick lees of mines and mills into something very different to what it was. Where birds once reared their young beneath the spray not a twig is seen, mounds of barren earth rise where May-poles by lusty arms were raised and dressed with spring's fresh flowers; but old names and old customs, a few of which could well be spared, still linger.

This battle with Nature has been going on from time immemorial, only that operations formerly were limited in scale, being confined to the "basset" or outcrop of the coals. Dr. Plot, writing in 1686 describes the class of mines then worked, at which time wood was used for smelting, the produce being from two to three tons in twenty-four hours, a quantity of which the worthy doctor boasts as "a great improvement over the methods of our ancestors." Even now the extension of iron making, notwithstanding, the marvellously increased scale of modern operations, is less considerable then might be expected from the vast capabilities of this rich coal field.

Old companies, however, are increasing and employing their plant and appliances, and new ones are reaching out further to the west, and all are preparing to go deeper, in order to follow the second and third series of ores and coals beyond the faults which intersect the field, and which, without modern machinery and the present advanced methods of mining, would be inaccessible. Indeed, the aid science has of late lent to mining is being repaid with interest, and will be to a larger extent than at present as mines become more developed on the west. The coal field of South Staffordshire is gradually diminishing, whilst that in North Staffordshire is greadually increasing, or rather showing fresh indications of additional resources and unexhausted stores. South Staffordshire, notwithstanding its Thick coal, has but 22 seams of coal, of a total thickness of 65 ft. of that mineral, whilst North Staffordshire has 27 seams, 137 ft. in thickness, in addition to 10 seams of ironstone, 22 ft. altogether, embracing the Silverdale Top Mine, the Gubbing, and others, containing from 31 to 35 per cent. of iron; but the mines which yet lie for the most part untouched are richer than these. The Cannel coal and shales of this portion of the field contain much oil, and several works have been established where from 1 ton of such material 30 gallons of crude oil are extracted.

The new line sends off accommodating branches at Silverdale, one of which runs through the Leycett Colliery, worked by the Lycett and Crewe Company, who lease upwards of 4000 acres for mineral purposes from Lord Crewe. The deep cuttings seen on emerging from Dunge Wood Tunnel, which is 400 yards in length, and again near the one at Stoneylow, exhibit some very interesting geological features—the former being through the upper unproductive coal measures of North Staffordshire and South Shropshire, and the latter through the cornstones, conglomerates, and other members of the Permians, the usual coal measure covering, dipping in the direction of Market Drayton and Childs Ercall, at which latter place Mr. Corbett is now boring in search of coal.

A glimpse of the pretty little village and church of Keel is obtained on the high ground on the left soon after leaving Silverdale, and a pleasant bit of country opens up between the Madeley and Whitmore stations, on crossing the Grand Junction Railway. Within a couple of hundred yards from the line, too, on the right, stands the crumbling ruin of Madeley Manor, a relic of bygone times. Elizabethan and modern mansions, too, with park-like woods and wood patches "unrestrained and wild above rule or art," are also seen, whilst the river Tern, described by an old writer as "a faire streame, and worthie to be well handed if it laie in me to perform it," is crossed and recrossed by the railway several times.

EXPLOSIONS IN COAL MINES.

SIR,—As the operative colliers and their delegates are calling loudly for increased inspection, legislation, and compensation, the following facts may not be uninteresting to your readers. About 12 or 18 months ago there was an explosion in a coal mine at Worsley, near this city, and seven or eight men and boys were killed. Passing the house where one of these men lay dead, I stopped and spoke to his sister, who was standing at the door. She said it was her brother's duty to go to the pit each morning, descend alone with a safety-lamp, and examine the workings. Should he find them free from gas, he returned to the mouth of the mine, and reported to the workmen who had assembled there that they might descend with safety and begin their day's work. She said that instead of the men waiting, as strictly ordered, until her brother returned each morning, they not only invariably accompanied him, but carried naked lights with them. He had paid the penalty of his neglect of duty with his life; for he ought, I presume, to have reported the men's conduct. In conclusion, the woman said, "We had been expecting an explosion for some days, as we knew there was gas in the pit."

Next day, passing near the same place, I saw 200 or 300 miners squatted on their haunches in a field, and in the midst was a cart filled with delegates, who in turn addressed the men. One of them said, amongst other things, "Isn't it shameful that these poor fellows should be killed in this way? But I tell you what it is—I wish to God that every time there is an explosion in a coal pit there could be a similar explosion under the master's office; we should soon cease to hear of accidents."—(Loud cries of "Aye, aye;" "That's th' way to sarve 'em.") Now, sir, I am acquainted with the owner of the mine where the so-called "accident" happened, and I know he is anxious that every means should be used to ensure, as far as possible, the safety of his men. He was shocked and deeply pained at the sad loss of life which had taken place, and it must have been a grievous thing for him to know that a heartfelt wish had been expressed that he might be blown to atoms.

It will be remembered that pipes, tobacco, and matches were found upon the bodies of all the men which were discovered after another coal pit accident—I think the terrible one at Talk-o'-th'-Hill—and it is known that miners habitually tamper with their safety-lamps when at work. Some time ago a learned professor was examining a mine in Cornwall, when, seeing the men enjoying their pipes, and throwing the matches about indiscriminately, he asked where they kept the gunpowder. One of them replied, "Why, you're sitting on it." In an incredibly short space of time the professor found himself half a mile from the mine, counting his limbs, in order to assure himself they were all there, and none of them broken or dislocated.

The work of a miner is neither harder nor necessarily more dangerous than that of a sailor in a trading vessel. Should the latter, when aloft, neglect the ordinary rules of prudence he would either fall on deck and break his neck, or tumble overboard and be drowned, without, at the same time, endangering the lives of all his companions, or the safety of the ship and cargo. The miner receives much higher wages than the sailor, and at Worsley, through the kindness of the Bridgewater Trustees, means of instruction are provided for the colliers such as no sailors ever yet enjoyed. It can hardly encourage the man of science to devote himself to the discovery of means for preventing accidents in mines when he reflects that his efforts may be rendered of no avail by the culpable neglect of the workmen.

The public mind has become almost accustomed to the frequency of colliery explosions, and to the misery and desolation caused by them. There is, too, a growing, and I fear well-founded, conviction that the great majority of such deplorable disasters are caused by the reckless disregard of rules and appliances on the part of the workmen. The Inspectors of Mines do their duty nobly, but whatever addition might be made to their number they would still be unable to supply the operatives with the caution, prudence, and forethought which are so necessary for their safety. Let the men, instead of calling upon Parliament to perform an impossible task, resolutely band themselves together, and agree instantly to report to the proper authorities any infraction of the laws which are provided for their common safety during the hours of labour. Then, and not until then, may we venture to hope that preventible accidents in coal mines will become things of the past.—*Manchester, Jan.* 24. W. H.

WREXHAM COLLIERY COMPANY.

SIR,—In the article upon the Wrexham Coal Field, in last week's Journal, I notice a few errors, which I should feel much obliged by your correcting in your next issue. The thickness of coal in the section at the foot of the article is stated as 2 yards 7 inches, instead of 2½ yards. The weight of water lifted is also given as 15 tons (3,500,000 gallons); it should have been 15,500 tons. It is further stated that "there will be an intermediate seam to go through—the Two-yard, or Crank and Brassey coal;" this should have read there will be nine or ten intermediate seams to go through, including the Two-yard coal, Crank coal, and Brassey coal. As regards the situation of the colliery, it stands between the Great Western line (as stated) and also the Wrexham, Mold, and Connah's Quay Railway; this latter line giving the Wrexham Colliery a direct communication with the London and North-Western Railway. WM. WILSON,
Jan. 25. Manager.

BOILER EXPLOSIONS.

SIR,—Much have been written lately about steam-boiler explosions, and the blame generally appears to be laid at the engineer's door; whether rightly or not I am not now going to discuss. I would, however, suggest to the mine adventurers that all boilers should be strong and well made. Let there be a man-hole under the tube near the bottom of the boiler, so that a man could go in to clean out and examine it. The tubes are generally too near the bottom of the boiler to allow of this. There should also be a blow-off cock under the boiler, which should be used three or four times a day if the water is foul. Then a glass water gauge, and two or three cocks to try the feed, and a steam whistle; otherwise how can the poor enginemen know the height of water, and to 20 lbs. of steam, how near they are to a blow-up? Next, a good safety-valve (two would be better), properly weighted to each boiler. I might add a float and steam whistle, but the above appliances properly looked after by our engineers, working engineers, and engine-men, would render steam-boiler explosions a thing of the past. I wonder how many steam gauges are there to our Cornish boilers? How many blow-off cocks and manholes? In how many mines, where more than one boiler is used for the same engine, do the engine-men work with one safety-valve, and load the others with bricks or stones? I am not without knowledge how these things are managed in Cornwall; for some years I have had charge of steam-boilers with all these apoliances, and the wonder to me is how more explosions do not occur where these simple yet inexpensive apparatus are not in use.

Cornishmen must be up and doing at once. Lives are precious, and much property is being wasted through non-attention to the requirements of steam-boilers. The boiler-makers must not forget a plug of lead in the tube, over the fire-place; something might perhaps be said for the badly-paid, hard-worked class—Cornish enginemen.—*Solstad Mine, Misterhult, Sweden.* JOHN SPRAGUE.

MINING IN COLORADO (U.S.).

SIR,—It is quite a treat to meet with your valuable Journal in this country; and I am glad to see that some persons are introducing its mines to the notice of English capitalists, as there is not the least doubt of their being well paid if they invest their money in them. I have been through all the mining districts of the country, and, judging from what I have seen of those now working, and the lodes just opened at the surface, and lying idle for the want of proper works to reduce and save the ore, I am fully satisfied that this is the richest mining district in the world, if the mines were properly developed. In the working of them there is certainly a very great error, and also in the saving of the gold, as not one-half of that raised is saved in the stamp-mill; and, in some instances, the tailings from the stamps that are running into the creek are of more value than what is saved in the mill. For some time past I have had men dressing these tailings, which will assay, on an average, 2 ozs. of gold and from 5 to 6 ozs. of silver per ton. This is said to be the only smelting-works in the district, and I may say the only one in Colerado that is entitled to the name of smelting-works; and here the ore is only run into what is called "matt," and then shipped to Swansea (Wales) for separation.

In my next letter I will send you the scale of prices paid by these works for the gold and silver ores, and the cost of smelting, as near as I can, and then you will be able to judge something of profits, &c. All that is wanted in this country is the proper working of the mines, and smelting-works to save the gold, silver, copper, and other metals. I hope in the coming spring to see some of our English friends here to judge for themselves, and then I have no doubt of their investing money to put up works at once. There are two places where I would recommend works to be put up at first—at Buckskin Joe, in Park County, and at Boulder City, in Boulder County. At these places coal of a good quality is plentiful, and can be delivered for about $4 per ton; and any quantity of gold and silver ore can be supplied, which is now idle for the want of smelting-works conveniently near.

During the summer months I have been working on the Hunter lode, and have had to carry our ore 110 miles to the smelting-works, at a cost of 5c. per lb. What would our English mining friends think of paying that amount for the carriage of ore as broken from the lode? In this lode we have two branches, one bearing gold and the other silver; the gold part is 10 in. wide, and will assay 9½ ozs. of gold to the ton; the silver part is 14 in. wide, and assays 540 ozs. of silver to the ton of ore as broken from the lode. Many such lodes as this are lying idle in the Buckskin district, which have been opened, and proved in depth and length, and many more can be opened—in fact, the mountains are full of gold and silver lodes, some of them being from 100 ft. to 150 ft. wide, and cropping out above the surface. Here, also, I hope soon to see smelting-works erected. I shall be most happy to spend a month with any party that will come out and go through the country, and see the prospects for themselves, and also give every information in my power respecting the mines.

Central City, Gilpen County, Dec. 28. H. B. GROSE
(Late of St. Austell, Cornwall).

MINING IN CALIFORNIA—PACIFIC MINING COMPANY.

SIR,—I see by your excellent Journal, of Dec. 18, that an effort has at least been made to give to English capitalists some of our good mines. I heard of a Mr. Batters, of London, being in our district in September last, and he would appear to have used his judgment to some good purpose in securing three such mines as I judge the Pacific Mining Company to be possessed of. He has, I notice in the prospectus, secured a gold quartz mine, called the Union Hill, in Grass Valley, and one of the richest and oldest hydraulic claims in our State, and also a rich and profitable silver mine in Nevada, so that the company would appear to be a threefold cord, not easily broken; but what I have to do with first is that which I know of my own knowledge, that the Union Hill is a rich and profitable mine, and in its infancy, and certainly cheap at the whole capital of the company. It is one thing to have a good mine, and another to have a good manager; good mines with bad management can be easily ruined. You English people had a good specimen of that in 1852, when, in my own district, the old Agua Fria, or Gold Hill, had mines that ought to have made millions, but wound-up with the loss of all the capital.

I am afraid the specimens we had of your English management in 1852 were not confined to California, but the same patent system would appear to be now adopted in the working of your home mines and markets, and splendid reports appear to please better than the working of an honest enterprise for profits. Mr. Batters, or the Pacific Company, would appear to make the start for honest working and profits to do our country good by showing what our mines can do. I called at Union Hill the other day, and found my old friend, Mr. Scoddon, stripped, hard at work, in high spirits, and at his post of command. The only change of ownerships appear to be that Mr. R. Watt, of the Eureka Mine, undoubtedly the first authority in all California, a rich man, and a honest Scotchman to boot, was in charge. My inducement in writing to you was not only to congratulate an English company on having secured three such mines, but that they should have had the good sense to avail themselves of local experience. Mining in our State is only about 20 years old, but the experience that has given us upwards of 200,000,000*l.* sterling must be worth something, and certainly must be of more value than fashionable "commissioners" sent out from England, whose chief occupation invariably is to spend money on themselves, and write flashy reports. If we had a few practical men and capitalists to come out and see our mines, and treat the public as the Pacific Company would appear to be treated, we should have no want of capital. Unfortunately, men who have no standing with us, and whom we know as loafers, find their way to England to sell worthless ledges for a few thousands, which serve in turn to be manipulated into the 100,000 shares game, being the gilded pill which would appear to suit the palate of John Bull. I had almost forgotten to tell you that Union Hill is making fine profits, and that a great improvement took place in the mine last week. A MINER.

Allison Ranche, Grass Valley, Dec. 27.

COPPER MINING IN THE LAKE SUPERIOR DISTRICT.

SIR,—Since I last wrote the Hecla Mine has paid its first dividend—$5 per share on 20,000 shares. This leaves with the treasurer $200,000; but, as no copper can be got into market until the spring, dividend No. 2 is not expected until July next, when it is purposed to pay $10 per share. The Calumet will then commence to divide its profits, and from both mines quarterly dividends of $5 per share are confidently expected. The capacity of those mines for the production of copper is almost beyond belief; for November the Hecla produced 336 tons, and Calumet 277 tons, of 80 per cent. mineral. The Quincy Mine produced, for October, 150 tons; November, 175 tons: South Pewabic, for November, 107 tons; Franklin, 75 tons; Pewabic, 50 tons; Phœnix and Central not reported on, but will probably each reach over 100 tons.

The shipment of copper from this county for the year falls below that of 1868. The Delaware has been suspended, and the Copper Falls Mine working a small force. For the two years the shipments were as follows:—

	1868.		1869.	
Cliff Mine	884 tons	1497 lbs.	606 tons	630 lbs.
Phœnix Mine	240 ,,	1332 ,,	565 ,,	1996 ,,
St. Clair Mine	42 ,,	115 ,,	—	
Bay State	6 ,,	1024 ,,	—	
North Cliff	—		3 tons	1565 lbs.
Allonez	—		2 ,,	1721 ,,
Central	About 1080 tons		1150 ,,	201 ,,
Copper Falls	About 800 tons		381 ,,	1495 ,,
Amygdaloid	—		21 ,,	1892 ,,

The greatest increase is in the shipments of the Phœnix, and it is not difficult to conceive that for 1870 they may take the lead, although it would lie in the power of the Central to exceed them if the price of copper warranted it, the latter mine having the advantage in the amount of ground open.

There is no improvement in the demand for copper; ingot quoted at 21¼ c. to 22¼ c. per lb. It is deserving of notice, however, that the heavy shipments of the Calumet and Hecla have been sold at 23 c.

I was very much pleased to notice that the Hotchkiss and Gardner stamps have been tried in Cornwall. There is *one* battery of them working at the Phœnix Mine, where it gives general satisfaction. It has been at work for thirteen months, most of the time night and day. No serious delay has occurred during that time, it having been stopped only twice for some trifling repairs. The stuffing-boxes of the cylinders require attention once in three days, the packing of the pistons once in three weeks. There is no perceptible wear or tear in the parts of the machinery, everything looking as well as new. In saying this I am not repeating statements, but making them, for I have had frequent opportunities of seeing the mill at work. The amount of rock stamped is said to be 40 tons per day. Much coarser grates are used than in Cornwall; for one cord of wood consumed 15 tons of rock is stamped, which is twice the amount of duty performed by the average of the stamping-mills of the Lake Superior region. The Phœnix rock is said to be softer than that of many other mines, but against that they have had insufficient and poor boilers. Almost every mine in Lake Superior has something different in its machinery for the reduction of rock. Ball's stamps seems to have been the favourite where a large amount of rock was to be reduced; but it is now pretty generally conceded that the last Ball's stamps has been set up. We are promised something further in the way of stamps this winter. The machinery came up on the last boats, and is to be set up forthwith on the Schoolcraft Mine. It seems to be something in the way of Ball's stamps, but not one quarter the size. The makers erect it at their own cost, the mining company accepting or refusing it after trial, as they may see fit. This looks like business. MINER.

Keewenaw County, Dec. 27.

THE AUSTRALIAN DIAMOND MINES.

SIR,—I am just returned from a long journey to the diamond mines in New South Wales, where I have had every facility afforded me for examining the various places producing gold and diamonds. During the last three weeks I have been over ground enough to convince me that the finding of either gold or diamonds is not confined to isolated spots; but I would not have the public believe that they can come here and pick up either merely by stooping for it. Although some diamonds have been found by washing river sand with a tin dish and other imperfect means, yet it will be found a delusion for men to hope to get even a low rate of wages by such means. Mr. Peacock and his party have proved beyond a doubt that the working of gold and diamonds combined can be made commercially important; the tailings from the long tom has given him one diamond to the load, besides the fine gold that had escaped.

I was gratified to learn that my ore-separating machines, with which you are well acquainted, are giving great satisfaction—indeed, they are acknowledged to be playing a very important part in connection with the diamond mining. At a dinner which I had the pleasure of attending at Driscoll's Hotel, Warburton, I was enabled to state that Mr. Peacock, who had travelled from Two Mile Flat to Ballarat, a distance of 900 miles, to purchase one of the machines, has it working well, and is in a fair way of being handsomely rewarded for the spirit of enterprise shown. The results obtained by the Australian and Mudgee Diamond Companies show a marked improvement in their last week's working; the former company obtained ninety-seven diamonds, besides gold, in the week, and the latter company ninety-four diamonds, besides gold, in the same time, and I feel satisfied that when the working of the machines is perfectly understood by the workmen employed more favourable results will be obtained.

We all know that the commercial prosperity of companies depend, in a great measure, upon judicious and energetic management. Let us hope that the gentlemen at the head of affairs in all the companies will do their utmost to bring about success. I think I ought not to forget that Mr. John Thomas Hunt obtained from a portion of the Australian Diamond Mining Company's ground, with a half-size machine, eighty diamonds in one week; but I cannot help thinking that it must have been a favourable spot. I am unable to say how many diamonds have been found up to the present. I have

weighed a considerable number, and find them average about a grain each. The price they sell for on the spot is about 10s. per grain. With regard to the alluvial drift most likely to produce diamonds, it would be premature to advance any theory until the ground has been further explored, but I have found a mineral with the diamond-producing drift, which I have never seen before in Australia, particulars of which I will publish later. The New Golconda Company have not yet commenced washing, but their machine, as well as one for Mr. Toby's party, is daily expected. I hope all will pay strict attention to the printed instructions for putting up and working the machines, without which success cannot be depended on.

I will thank you to publish as much of my remarks as you may deem desirable, for the information of my many friends among the readers of the Journal, and you may rely upon it that I will write you a long letter soon on the subject of Australian mines generally, as soon as I have got more reliable information. JOHN HUNT.

Chilwell, Geelong, Dec. 4.

Melbourne, Dec. 7.—An auction sale of diamonds from the Mudgee district was held in Melbourne the other day. This event was announced to be the precursor of a series of sales of the same kind in this city. Few of the stones disposed of on this occasion were of any respectable size, and none of them of a very good colour. The produce, however, seems to be increasing in what is now recognised as "the diamond district."

FIELDS FOR INVESTMENT.

SIR,—Of fields for investment in this country we are not destitute—fields as attractive as any foreign countries can show, and as long as these exist, in my opinion, it is manifestly the duty in the present state of the country, no less than the interests of investors, to give them a preference. Although trade has revived a little, yet we have thousands of willing hands unemployed still, and the retention, to a great extent, of capital within our own shores, and its application to purposes that would give them employment, may be considered of vital necessity to our prosperity as a whole. The retention does not apply to English capital applied in foreign lands to the production of raw material for our manufactures, such as cotton, &c., but it is specially applicable to that which goes into the majority of foreign Government loans, too often to prop up effete and rotten Governments. With our abundance of capital, and with so many avenues for its profitable employment—with thousands of acres of waste land to reclaim, and with still more to be enriched by the application of the sewage from our towns—and with boundless fields of mineral wealth to develope, not less rich than the much-vaunted ones abroad—it is discreditable that there should not be work for all.

There are few districts which have not some desirable work to carry out that cannot do something to absorb our unemployed population. The application of the sewage to the enrichment of the soil is a problem for nearly every town in the kingdom, and its solution, not difficult in most cases, would give permanent employment to thousands, and add greatly to our national wealth. Again, few districts would not be interested either in the reclamation of waste land, or in the development of neglected mineral wealth. Ireland would be specially interested in both, and, were the necessity recognised by Government of creating permanent sources of employment in such fields, it would go far, in my opinion, towards restoring content and loyalty to the miserable and disaffected population of that country. Wales, again, affords as abundant a scope for the profitable employment of labour and capital. One field deserves especial mention—the estuary of the Dee (Flintshire), where thousands of acres of rich alluvial soil, of great value for agricultural purposes, lie waste, which no very heavy outlay would reclaim, while by its reclamation millions of tons of excellent coal, now comparatively unattainable, would be brought within the easy reach of the skilful miner. It is true that the coal under it is won at two or three points, whilst preparations are made to win it at others, notably at Bagillt; but until the waters are excluded, and confined to one central channel, it can be won only under obvious disadvantages. Simultaneously with the operations at Bagillt, I should like to see embankments run out—pits in the course of sinking, not only at the margin, but near the centre of the estuary, remote from the accumulations of water in the old workings at the outcrop of the coal—and other signs of activity. Were the community to recognise as no less its duty than its interest to find employment for all, and to pay attention to such fine fields for the profitable employment of capital and labour as this is, soon would the cry of stagnation of trade, so oft repeated, be unheard, soon would the tide of pauperism overflowing the country be stemmed, and soon would all marvel at the beneficial change wrought in the condition of the country. I believe, too, it cannot be gainsaid that the most profitable employment of capital, as well as the most beneficial to British interests, is in the development of her natural resources, agricultural and mineral, and the man who applies his capital in judicious agricultural and mining investments consequently pursues not only his own good, but also the good of his country, and may be deemed eminently patriotic and wise.

M. F.

MINING IN FLINTSHIRE—EMIGRATION.

SIR,—This once flourishing county of Flintshire, with numerous rich lead mines, is now filled with poverty. Several of the largest mines, that gave employment to some hundreds of men, have been stopped within the last two years—Coed Hendra, Great Rhosesmor, New Westminster, Billins, Bryn Gwiog, and others. Thus one-half of the lead miners of the district have been thrown out of employment, and many families are in want of the common necessaries of life. Now, the question of Emigration stands prominent before the public, and it is asked by some whether the unemployed working man would be benefitted if some scheme could be adopted to accomplish his removal to America or the British colonies. In this we think there ought not to be two opinions, for the facts are that wages throughout the United States, from California to Lake Superior, are double what they are in this country, and the same may be said of Australia and New Zealand, while provisions are equally cheap as in England, and it is not too much to say that if the American or Australian miner is economical, he can save as much as the English miner can earn, whilst they have the great advantage of purchasing land at a very low rate. This hundreds have done, and have made comfortable homes, and are well provided against sickness or old age. We are not speaking at random, but what we have seen both in Australia and America, and it appears all the influx of emigration does not tend to lower the wages, as numbers of miners leave the mines every year to settle on their own freehold land, and this gives room to new comers.

We do not despair, but believe there are good mines yet to be discovered in England and Wales, though our chances may not be so great in this country that has been mined for a thousand years, as in new districts just commenced to be explored; and whether we send the unemployed miner to those regions or not, we may depend on it we shall have the foreigner to compete with, though some would even make us believe the last cargo of mineral was on its way to our shores, and that we shall soon have the market to ourselves; but not so—on it comes, and will continue to come. It is better to look at things as they really are. A wise general never aims to undervalue the strength of the enemy, but makes proper arrangements to meet him. In meeting foreign competition, let our great "guinea-a-minute landlords" cease at once to receive royalty from all mines that are working at a loss, and thus give encouragement to companies, who are the nation's greatest benefactors. It is evident the lords of the soil will have to show more liberality, or English mining will decline. Already English capital is floating copiously for the working of the mines of Australia, California, and Nevada, and we wish those worthy enterprising gentlemen every success, and hope they will do something for the unemployed miners of England and Wales, and if work cannot be obtained for them here, to send them elsewhere to get bread for themselves and families. R. NANKIVELL.

Pennant Mine, Jan. 26.

[For remainder of Original Correspondence, see this day's Journal.]

ARITHMETIC.—The first part of an ingenious and valuable treatise on "The Science and Art of Arithmetic," by Messrs. A. SONNENSCHEIN and H. A. NESBITT, M.A., has just been issued by Messrs. Whittaker, the well-known school publishers, and will, doubtless, be thoroughly appreciated by those for whom it is intended. The system may be described as modified Pestalozzian, or as occupying, in fact, a similar position with regard to arithmetic as the Ollendorf occupies with regard to philology. The authors entertain the opinion that the student must be led to the discovery of the several rules by some path such as an original discoverer might have travelled; for example, subtraction must lead through cumulative subtraction to division, which, in its turn, leads to fractions, and these again lead to the idea of ratio and proportion—they hold that for educational purposes the "seeking of the truth is worth more than the finding of it," and deny that the method of teaching they advocate is slow and barren of results. Progress, they continue, is not synonymous with mere advance from rule to rule. A thorough and all but visual realisation of each process gives the young student a feeling of power and perfect mastery, which obviates the necessity of perpetual recapitulation. An experience of upwards of twenty years has shown them that the more nearly they have approximated to this their ideal the better the results have been, even when subjected to the severe test of competitive examination. The book is chiefly intended to guide young teachers, and for this it will prove invaluable, whilst those instructed by a teacher who works with will have no cause to fear that at the completion of their studies they will be second-rate arithmeticians.

MINING IN AUSTRALASIA—MONTHLY SUMMARY.

VICTORIA, DEC. 6.—Among the returns reported is that of a cake of gold weighing 547 ozs., the produce of 159 tons quartz from a claim at Junee. A nugget of upwards of 34 ozs. has been found at Tyler's. A rush to Fiddler's Creek, 5 miles from Avoca, has taken place. Workings alluvial; about 600 diggers on the ground; it is believed this will prove an extensive but comparatively poor gold field. A proposition, emanating from Ballarat, for the establishment of a School of Mines is regarded favourably. A large number of diamonds found by the Mudgee Mining Company at the Two-Mile; one estimated at 70*l.* value; 170 stones found in 20 days. A party of three obtained near Buckley 16*l.* worth in a week by washing in an ordinary cradle. Operations are steadily pursued at Barossa, with occasional finds of importance; a crushing at Goddard's Hill on Nov. 25 of 7 tons yielded over 5 ozs. of gold to the ton. A large tract of country has been taken up near Mount Lofty, about 11 miles from this city, and is highly spoken of. Some fine specimens of gold taken from the Balhannah Mine within the last week. The Almanda Silver Mine has resumed work, and good returns are reported each week.

YORKE PENINSULA.—The fact which we have repeatedly alluded to, that more copper ore is being raised on the Peninsula at the present time than during any former period of our history of the same duration, has been demonstrated during the past month. In the Annual Register for the colony, compiled by the Government statist, and just published, it is shown that during 1868 more ore was raised than during 1867, and it is probable that the quantity to be detailed for 1869 will be a largely increased one. The Wallaroo Mines are far more productive than they were ever known to be, and the prospect of the yield being not less for many succeeding years is as great or greater than it ever has been previously. At the Moonta Mines operations in the old shafts are being vigorously prosecuted, and new ones are being constantly opened which give the best prospects. The Paramatta Mine is yielding in a manner that more than equals the sanguine expectations of shareholders, and the prospects of the Yelta are undeniably first-rate. Present appearances warrant the assumption that there are no mines on the Peninsula with a better prospect before them than this, which but 18 months ago was deemed barely worthy of notice. The New Cornwall again ranks as an ore-producing mine, and its machinery for cutting and dressing ores will be in working order and fully employed, we believe, next week.

An English Company has, within the past month, experienced a favourable turn of the wheel of fortune. For the credit of the mining world—sometimes said to be composed of a pack of swindlers—the fact deserves to be noted that, after hearing expressions of opinion from mining authorities in various quarters, we can say all those persons interested in mines we have had communication with have been unanimous in their expression of joy that a slice of good luck has fallen to the lot of an English company working a mine in South Australia. The Kurilla Mine is worked on a royalty by English capitalists, who spent a very large amount of money at the Bon Accord Mine. Nothing more promising than a lode recently bared in their Kurilla property has yet been opened on Yorke's Peninsula. With these favourable examples before them it is scarcely necessary to state that the captains of younger mines are vigorously pushing on operations; and at the Wheal James and Poona Mines encouraging results have been obtained. By this short account it will be seen that the mining interest will bear comparison with either of the other two staples in the colony—the pastoral or agricultural.

BURRA BURRA.—The workings have been resumed in a small way at the Burra Mine; they are, however, but a prelude to more enlarged and more important operations. The improved system alluded to in former reports will be carried out under the management of Mr. Swanborough. A portion of the new machinery came out from England by the Orient, and the rest is expected out shortly.

AUSTRALIAN MINES.

YUDANAMUTANA (Copper).—The directors have advices from the superintendent (Adelaide, Dec. 8). By a telegram received within the last hour, I hear that 13 tons of metal have been run for the week ending Dec. 4, making 48 tons run for the month of November. This is an improvement upon the returns of late, and if it continues I am not without hope that by the mail which brings you the accounts to Nov. 30, I shall be enabled to send you a financial statement to the date of the January mail leaving, and which will show a great improvement in our position.—Mining: The north mail is due here in two hours. By the last mail we received no report for the board from the captain. Therefore, I presume that he is under the impression that the mail of this week will be in time for the outgoing English mail. I send you an extract from his official letter of last week, by which you will see that the mine is still holding as well as ever, and that our smelting operations are going on more satisfactorily. The following is the extract referred to:—Blinman Mine, Nov. 29: I am sorry to say that just after I sent the telegram another accident happened to the winding gear. The scotch on the barrel where the clutch takes hold broke, taking away part of the barrel with it, but I have not been thrown back in the least by the accident, as I put the whim at work at once. It does the work just as well. The furnaces have been working splendidly the whole of the week. Copper made 11 tons 12 cwts. 1 qr.; this make with three new bottoms put in is good work.

The following is a summary of the report of the select committee of the House of Assembly on the Port Augusta Railway:—Your committee in the prosecution of their enquiry have examined various witnesses, and have received documentary evidence. The whole of the evidence goes to show that the country in the far North is exceedingly rich in mineral deposits, and offers a rare opportunity for the profitable investment of capital. It is in evidence that one mine alone (the Blinman) is supporting a population of 1500 persons, and that if facilities of transit were offered, there are many mines of equal and even superior value that could be immediately and profitably worked. From the evidence adduced it is shown that during the late drought, there being no means of conveying provisions into the far North, many of the runs were abandoned, causing serious loss to the squatters, whereas had there been means of forwarding supplies the stock would have been saved, and the country occupied. Your committee consider that it is of great importance that a railway from Port Augusta to the far North should be constructed, and although they cannot recommend any extension of the guarantee provided in Act No. 22, of 1867, they would recommend as an alternative that the right to select a certain area of mineral or other country should be offered to capitalists on condition of their constructing such railway for a distance of at least 200 miles north of Port Augusta, within say five years from the date of their acceptance of such offer.—W. TOWNSEND, Chairman, Nov. 30.

PORT PHILLIP COLONIAL (Gold).—Mr. Bland, Clunes, Dec. 3: The quantity of quartz crushed during the four weeks ending Nov. 10, was 4630 tons, yielding 1019 ozs. 7 dwts. of gold, or an average per ton of 4 dwts. 9¾ grs. The receipts were 3890*l.* 18s. 10d.; payments, 4177*l.* 19s. 8d.; loss, 287*l.* 0s. 10d. Deduct from which last month's credit balance of 73*l.* 15s., and there remains a debit balance of 213*l.* 5s. 10d. The return for the first two weeks of December account:—Quantity of quartz crushed, 2375 tons; pyrites treated, 46 tons. Total gold obtained, including that from pyrites, 532 ozs. 16 dwts., or an average per ton of 4 dwts. 12 grs.

WORTHING.—Thos. Prisk, Dec. 4: The engine-shaft is being sunk as fast as possible, and the ground continues good. The 93 north end is now driving through the hard bar that we drove through in the 83 north, but is not so hard for driving as it was in the above level; the lode is about 2½ ft. wide, of dredge work; present price for driving, 11*l.* per fathom. The south end for the present is stopped, being up to the hard bar. In the 83 north end we have met with a small cross-course, which has disordered the lode, but I am of opinion that in a fathom or two driving the lode will be all right again, as the water is pouring out so very strong; present price, 7*l.* per fathom. The 63 north end has very much improved since the survey day; the lode is 2¼ ft. wide, and will yield from 2 to 3 tons of ore to the fathom, and improving every cut we put over the end; present price, 11*l.* 10s. per fathom. The rise in the back of the 83, and the winze in the bottom of the 63 north, we hope to hole some time this month, which will greatly improve the ventilation in the north part of the mine, which is greatly needed. The lode in both the rise and winze is good all through, and will open up good stopes; the price for the rise is 8*l.* per fathom, and for the winze 14*l.* per fathom. We are driving the cross-cut at the 93 with two men towards Boundy's lode, and the ground continues good; present price for driving, 6*l.* per fathom. We are driving north-east on a caunter branch, and so far as we have driven it appears to improve; we shall be able to tell more about this in our next report. The stopes are about as usual. The quantity of ore raised and dressed for the month is 270 tons; copper shipped, 23½ tons; ore on hand, 73 tons; and regulus, 13½ tons: the number of hands employed, 139.

YORKE PENINSULA.—The directors have advices from the committee of inspection at Adelaide (Dec. 3), and from the Kurilla Mine to Dec. 6. Capt. Anthony reports:—At Deeble's shaft, after cutting from the bottom of the shaft to and through the lode, sinking was commenced on the 29th ultimo. One fathom is sunk, and the yield is 10 tons of about 20 per cent. ore; price for sinking 12*l.* per fathom. It will be a great relief when this place is drained of water from the 25. No change for the worse is taking place, except that the yellow ore underlying the grey is of rather lower percentage. The lode is 5 ft. wide at the bottom, and the ore 15 per cent. as broken. A good lode is standing in each end of the shaft. Should this bunch of ore hold good in depth the value of the mine is established, and at present it shows no signs of decline. . . . At the 25, driving west from Hall's shaft, the lode is 2 feet wide, and showing signs of improvement as it nears Deeble's shaft. I have fixed water-pipes from the 15 to the 25 fm. level to convey air by falling water to this place. The air chest is fixed, the whole of the air-pipes are on the mine, and some of them are also fixed. I shall now double former progress at this place. . . . The progress made in Hall's engine-shaft during the past month was greatly retarded by an accident to the pitwork. . . . Total depth from surface, 39 fms. 1 ft. It affords me much pleasure to inform you that the prospects of the mine are highly encouraging. (38½ tons of ore had been sold, and about 41 tons more were on the floors or in course of realisation.) The committee write—"We forward account sales of two parcels of ore from Deeble's shaft, averaging about 20 per cent., and, so far, fully answering Capt. Anthony's expectations that it would pay expenses." With regard to the Bon Accord property, the committee report that a good demand existed for allotments in the Aberdeen township on that property near the railway terminus which the Government have determined to place upon it. The committee have not required to draw on the directors by the present mail.

AUSTRALIAN UNITED (Gold).—The directors have advices from Mr. Kitto (Fryer's Town, Dec. 6).—Duke of Cornwall Mine: We have struck the lode in the bottom (200 ft.) level; it is 14 feet thick, well defined, and sufficiently productive to ensure the success of the mine. A trial of 17 tons taken indiscriminately from the reef gave 6 ozs. 10 dwts. of gold, equal to 7 dwts. 15 grs. per ton. I have let portions of this mine on tribute, with a view to its paying its own way. The discovery, however, in the bottom level is of a character to prevent the necessity of such a system. The furnaces are completed, and answer the purpose for which they are intended admirably. The first charge will be dealt with next week.—Central Mine: The shaft is now deeper than any other sunk in the district, and there is still no sign of bottom. Great local excitement prevails pending the finding the gutter, as it is anticipated that I shall open up a new gold field equal to Ballarat. You will have very good news by the next mail.——Capt. W. H. F. Williams also reports on the Duke of Cornwall Mine, under same date:—I beg to hand you report of the mine for the past month.—Daukes's Eastern Cross-cut, 200 feet level: Since last report we have struck a large body of quartz about 45 ft. from the shaft. We intersected the floorkan, east of which we struck small veins of quartz, varying in size from 6 to 10 in. wide; the last 14 ft. have been through solid quartz, averaging 7½ dwts. per ton. We are now going through a sandstone bar, and the water is still coming out of the breast of the drive, strongly indicating that we are not far from more quartz.—Daukes's, 133 ft. level: We have let the stopes on tribute, at 10s. in 12. No clearing up has yet taken place.—Beare's Prospecting Shaft: We have sunk this shaft 104 ft., to the water level, and are now driving east for the eastern lode, and west for Ferron's; I hope to be able to report on the lodes next time.—Remarks: The burning-house is completed; we shall commence to operate on our sulphurets this week. I hope to be able to report on its progress in my next. All other works are going on favourably.

CENTRAL MINE.—Capt. H. Holman reports: Everything here is going on very well, considering that we are now and have been for the past week in a very fine drift, although I consider if we can sink and make secure one-half of what we were doing before it will not be bad work until the drift shall have been passed through; depth of shaft 194 ft., and can put down a lath anywhere in the bottom 4 ft., and some places more. We are going to put in a set of bearers this week, to fix the screws for carrying the lift, as I do not think it safe to trust the chains alone. The engine works very well, and it is becoming the general opinion that we cannot be far from the gutter or lead, if not actually over it. There is no sign of bottom, and I can offer no better opinion than to allow the depth of the shaft to speak for itself. The water is very fast, we have to go about six long strokes per minute to keep the coming water.

ENGLISH AND AUSTRALIAN (Copper).—The directors have advices from their manager (Newcastle, Dec. 2), and from their sub-manager (Port Adelaide, Dec. 8). The stock of coal on hand at Port Adelaide was about 964 tons. The return of furnaces at work at Port Adelaide has not been received by this portion of the mail. The 200 tons of copper advised by last mail as in course of shipment had been increased to 230 tons, and shipped, and a further shipment of 30 tons had been made. The Ambassador, with the first portion of the materials for the new smelting works at Newcastle, had arrived at that port, and the City of Sydney, with the remainder, had reached Sydney.

SCOTTISH AUSTRALIAN.—The directors have advices from Sydney (Dec. 3), with reports from the Lambton Colliery to Nov. 30. The sales of coal for November amounted to 17,817 tons. This return includes the 2400 tons of coal mentioned in the return of the October sales as being on board vessels partly loaded during that month. The actual sales for November, therefore, would be more correctly stated at 15,417 tons, as against 11,740 tons for October.

AUSTRALIAN GOLD FIELDS.—Among the good returns recorded in the accounts received from Victoria by this mail is a splendid cake of gold, weighing 547 ozs., the produce of 159 tons of quartz from the Eaglehawk reef, at Junee. A nugget weighing more than 34 ozs. was also got at Tyler's. A new rush has been made at Fiddler's Creek, about five miles from Avoca. About 500 Chinese and 100 Europeans were on the ground. In one instance a quarter of an ounce to the dish was obtained. This is supposed to be an extensive gold field, but comparatively poor. The unparalleled yield of a crushing of stone from the Hawkins' Hill reef, at Tambaroora, New South Wales (1819 ozs. of clean retorted gold from 9¾ tons crushed), has already been mentioned in the *Times*. Some other extraordinary yields have been obtained recently from the Tambaroora reefs. The want of water is the great drawback in this locality; a permanent supply requires the outlay of a large amount of capital. The Tasmanian gold fields begin to attract attention in Victoria. Skilled visitors express surprise at the obvious richness of the stone at Fingal and Waterhouse, and say that the reefs exposed, if in Victoria, would create a *furore*. The Tasmanians are displaying a good deal of enterprise, and with a fair prospect of being adequately rewarded. In New Zealand some very rich finds are reported at the Coromandel; 800 ozs. of gold were taken from 400 lbs. of quartz. The estimated yield for the quarter ending September, from the province in which the Thames gold fields are situate, is 20,743 ozs. Gold-bearing quartz reefs are being discovered in various parts of the Nelson Province, both on the east and west coasts. Experienced judges declare that the Wangapeka country and neighbourhood are the most promising in all the colony. Now that a better understanding is being arrived at between the Maories and the Europeans, there is every probability of the latter being allowed to penetrate even the remotest districts of the colony, and to pursue their search for gold unmolested by the natives.

NEW ZEALAND GOLD.—Astonishing results are being obtained on the gold fields in the Northern Island of New Zealand. A dividend of 30*l.* per share was paid by the Golden Crown claim, Nov. 1; and another dividend of 20*l.* per share followed, Nov. 16. The yield of gold by the Golden Crown claim in October was 2667 ozs., of the value of nearly 10,000*l.* A new and exceedingly rich leader has been struck in the Long Drive claim, which produced from Oct. 13 to Nov. 18, 4210 ozs., of the value of 11,000*l.*

THE AUCKLAND GOLD FIELDS.—It has been reserved for that province of New Zealand which has so long been under both a political and commercial cloud to enjoy the most complete flood of "golden" sunshine yet known in the southern hemisphere. The gold that has been hidden at her very threshhold is now opened as a vast storehouse of wealth for Auckland. The returns we publish in our summary from that place seem almost fabulous, but as the gold does really come home for English goods, we are compelled to acknowledge that all previous finds of the precious metal in the southern hemisphere have been completely eclipsed by the Thames gold fields. We rejoice in Auckland's present great success, not solely on account of this addition to her wealth in gold, but because it will attract to her shores a population that must (as such discoveries have done wherever they have been made) open up a land that only waits cultivation to render it an immense producing country. Our readers need scarcely be reminded of California, which before gold was found was little heard of, while it is now one of the great "agricultural" States of the Union. Already Otago, the first worked New Zealand gold field, exports corn to the mother country, therefore we cannot but hope that Auckland will quickly follow in its wake. To emigrants of the working kind the northern province of New Zealand presents a most enviable field.—*New Zealand Examiner.*

FOREIGN MINING AND METALLURGY.

The state of the Prussian iron trade in the Essen district has not experienced any change of importance. The demand for rough iron and pig has assumed such dimensions that the blast-furnaces cannot produce all the quantities required from them. Thus the Prussian Mining and Iron Works Company, at Dusseldorf, has been obliged to refuse an order for iron to be delivered at the rate of 500 tons per month during 1870, for the simple reason that the concern had already entered into engagements with regard to the whole of its considerable production. The advance in prices, anticipated for the whole of last year, is now established; the cause assigned for the rise is that the importation of rough English iron has diminished since the heavy engagements which English works have contracted absorb almost the whole of English and Scotch production. Another cause of higher prices is that little by little the want of coke has become so sensible that some blast-furnaces have been obliged to restrict the production as much as possible. The advance established by coke has been at the rate of 1s. 8d. per ton—that is, from 14s. 4d. to 16s. per ton. The blast-furnaces of the Siegen district have especially profited from the want of coke, and their proprietors have not hesitated in consequence to stand out for higher rates. The market for merchants' iron has remained animated in Prussia; orders have arrived in abundance, and prices have continued to advance. The production of T and double T-iron increases more and more, and the same may be said of U-iron. Of all branches of siderurgical industry the production of rails is, however, the most prosperous in Prussia. As an instance of this, we may state that a few weeks since Dr. Strousberg hired from the administration of the Berg and Mark Railway Company 700 trucks for the delivery of rails, intended to be laid down on lines in Wallachia. It may be remarked that the managers of almost all the lines which are under the control of the State delayed to give out their orders for 1870 until the end of last year, probably because they hoped by this means to produce a want of work among the rolling-mills, and to cause a fall in prices. But instead of falling, the price of rails has risen, and when orders for 1870 could no longer be delayed about 50,000 tons of rails came all at once on the market—about 37,500 tons for Northern Germany, and 12,500 tons for Southern Germany. What renders this state of affairs of especial importance is that almost all the rolling-mills were fully engaged for 1870 at the close of 1869.

The price of coal has experienced no variation in the French coal basins, but freights from Anzin for Paris, Rouen, Elbeuf, Amiens, Cambrai, Péronne, St. Quentin, Compiègne, Rheims, and Soissons have sensibly fallen. At Paris, business in the best descriptions of coal has fallen off, from the absence of severe weather, and the quiet tone which prevails every year at the period of stock-taking. It must not be concluded from this that there is a check in the deliveries from the basins; such a supposition would, indeed, be a grave error, as the arrivals from the basins have been, on the contrary, very well sustained, favoured as they are by a quantity of water sufficient for the navigation of boats, and by the fall in freights from Anzin and Charleroi for Paris, from which merchants profit in laying in supplies. There is some expectation that under all the circumstances a fall will be witnessed in prices at Paris. We are happy to announce that the Northern of France Railway Company, in consequence of continued complaints as to want of trucks, has ordered a large quantity of rolling stock, intended to be devoted to the conveyance of mineral combustible. This additional rolling stock will, however, come upon the company's system too late to be of much service during the present season. Tolerably favourable advices come to hand from the different metallurgical groups of France. In the Champagne district pig, which had been neglected for some time past, has revived, and has given rise to numerous transactions. For charcoal-made pig for refining, taken at the works, 4*l.* 8s. per ton has been paid; this is equivalent to 4*l.* 10s. to 4*l.* 12s. 6d. per ton of the purchasers. In the Blaise, some blast-furnaces have concluded transactions at 4*l.* 12s. per ton. Mixed pig is currently accepted at 3*l.* 16s. per ton, and as the animation in this article is rather considerable producers have become exacting. The demand for iron is quiet in the Champagne district, with the exception of machine iron, which is the object of sustained orders; prices are, upon the whole, supported with firmness. The forgemasters of the Moselle district complain of the advance which has taken place in coke, especially when they have had to submit to additional charges in consequence of having recourse to railways, through the interruption of navigations for several months past. Now that navigation is re-established, consi-

derable quantities of coke have arrived by the canal from the Marne to the Rhine. The rise indicated in coke does not appear likely to continue, as the consumption of this combustible, far from increasing in the Moselle, has a tendency to decline. For three furnaces blown out at Hayange, a small furnace at Cona-la-Granville has been blown in. The production of iron and plates continues to be very considerable in the Ardennes; all the works are well off for orders. The Vireux rolling mills for rails are working with much activity; their production places them among the great manufacturers of France. The Messempré Carignan Works have great difficulty in meeting the orders which they receive for plates. The Flize and Montherme works are doing a good deal on Parisian account, and the St. Charles forges are, it is understood, to be demolished. Little Belgian iron is stated to be now entering France, but, on the other hand, Swedish iron abounds. Mention is made of a Swedish house which has created a depôt at Charleville. The foundries are pretty well employed, but the selling prices are not remunerative, except for great houses; small works sustain with difficulty the competition they have to endure.

The Belgian coal markets maintain a prosperous tone, as the want of railway trucks prevailing at certain points sufficiently indicates. Freights show some activity, in consequence of the difficulty experienced in securing the transport of coal by railway. There is not much to note in connection with the Belgian iron trade, which continues, however, prosperous. The Esperance Collieries, Blast-Furnances, and Rolling Mills Company has issued its report for 1869. The company appears to have experienced last year a want of outlets for its coal, and prices declined about 6 per cent.; three-fourths of the coal extracted was employed at the company's works. Of three pits owned by the concern two have been in activity during the past exercise; the first, which is being deepened, will become the principal theatre of working operations. The production of coke last year at the company's coke furnaces increased 21 per cent., as compared with 1867-8; 30 per cent. was employed at the works, and the sale price of the remaining 70 per cent. declined 5 per cent., as compared with 1867-8. The production of the blast-furnaces increased 50 per cent. last year, a second blast-furnace having been lighted; 32 per cent. of the production was delivered to general commerce. Various improvements were introduced last year into the production of the iron made by the company. The net profit realised in 1868-9, after providing for expenses of management and interest on loans, was 10,097*l.*; after making various redemptions, &c., a dividend of 4*s.* per share was paid to the shareholders.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XX.—Having explained (said Mr. SMYTH) in some detail the advantages of the safety-fuse, and the particular circumstances out of which, in the older system of blasting, danger was to be apprehended, I will now mention other modes of firing charges, only adding to what I have said that the safety-fuse at present is the method adopted in almost every European country, when the ground is wet from the facility with which it can there be employed, and the undoubted diminution of accidents which its use has brought about. The great Dr. Franklin pointed out many years ago, and demonstrated, that charges of gunpowder could be fired by electricity, and from his time downwards there has always been more or less experimenting with the view of thus rendering electricity useful. It was not, however, until the successful operations of Sir Chas. Pasley in blowing up the wreck of the Royal George at Spithead that the advantages of electricity were practically proved, and it was shown that in operations on a large scale, at any rate, galvanic agency could be turned to account. Large charges in military mining are now invariably fired by electricity wherever it can be applied. Its great advantages are that it affords a security, a certainty, and a simplicity which cannot be effected by any other means. Electricity has been employed on the greatest scale, and many years ago at Holyhead its superiority was established in the construction of the great breakwater there, under the direction of the late Mr. Rendell. The mode of firing charges by means of the galvanic battery is very simple. Instead of a fuse there will be a small cartridge of fine sporting powder, and two extremities of the wire connected with the negative and positive poles of the battery, and between them a small piece of thin platinum wire. The latter becomes intensely heated, when the current of electricity is made to pass, and the discharge takes place instantaneously. There used to be an idea that much scientific knowledge was necessary for the application of electricity, which delayed, and, indeed, now hinders, its application to mining. It is, however, becoming much more generally used. Several eminent electricians have devised machines which are both handy and portable. That of Prof. Wheatstone (exhibited by the lecturer) is contained in a box 1 ft. long, 8 in. deep, and 6 in. wide, so that its application in the workings of a mine is perfectly easy. All that has to be done is to have the wires of sufficient length, and the operator in a position beyond the reach of danger, and then all the men being withdrawn, a premature discharge or danger from a mis-fire is impossible. The direction of the bore-hole is an important consideration in blasting, and it is one which is most frequently left to the knowledge and experience of those to whom the work is confided. Tact and judgment will do more than any scientific rules both in placing the holes and in fixing the amount of the charges to be employed, and the latter may vary from 2 or 3 ozs. to 100 lbs.

Some of these operations have been carried on where many tons of powder were requisite, and it was important, therefore, to act with as great accuracy as possible. The first thing was to determine "the line of least resistance," or the direction in which the powder would take the greatest effect. This was generally, in a military mine, a vertical line, reaching from the centre of the charge to the surface, or the shortest line to the open air, and the charge was proportioned according to the ratio of the cubes of the lines of least resistance. Thus, taking the line of least resistance to be 6 ft., and finding by experiments that 22 lbs. of powder were required to produce a given effect in that case, the rock being of chalk or rubble, then a 7-ft. line of resistance would require 35 lbs. ($6^3 : 22 :: 7^3 : 35$). In the same way, if the line of resistance were 12 ft., the charge would not be double that at 6 ft.; but as the cube of 6 to 22 lbs., so the cube of 12 would be to a result of 176 lbs. ($6^3 : 22 :: 12^3 : 176$). The increase, therefore, of the charge was extremely rapid, and the practical usefulness of these calculations was remarkably exemplified by the accuracy with which they were borne out in blowing down the chalk cliffs between Dover and Folkstone, for the South-Eastern Railway. It was then found that 1-32d of the cube of the line of least resistance in feet gave the charge in pounds. On this rule the calculation was made, and it was found that the charge for each of the side holes would be 5500 lbs., and for that in the centre 6750 lbs., although, in order to render the calculation safe, a rather larger charge (7500 lbs.) was allowed for the middle, making a total of 18,500 lbs. of powder. The three charges were fired simultaneously by a galvanic battery; and the effect was remarkable—there was no great noise, and no great amount of fragments, but the base of the cliff bulged out, and the whole of the superincumbent mass sunk down. The height of the mass thus dislodged was 380 ft., and the quantity taken away was estimated at 405,350 cubic yards. The same method was employed (as I have mentioned) in the great quarries at Holyhead from the year 1850 to a recent date, for the purpose of obtaining large masses of hard quartz rock, for the construction of the breakwater and other works at that port. Boring and blasting of the usual kind had become very expensive, and this mode of using large charges, fired by a galvanic battery, was introduced with immense success and economy. It was then found, of course, that 1-32d of the cube of the line of least resistance would not do, but that the charge must be much larger, on account of the greater hardness of the rock, so that the calculations were based upon from a tenth to a fifteenth, and with similar success, the result being that 10,000 tons of rock were sometimes dislodged by one blast. In other operations elsewhere the same rule was found to apply.

There are rocks, however, so hard that the cost and difficulty of boring holes for blasting are enormously disproportioned to the result produced. Thus, I could mention a case in which between 30*l.* and 40*l.* a fathom was paid to the men for driving, and they found they could not get wages at it, and threw up the job; and in some varieties of greenstone 70*l.* a fathom has been paid merely for driving. In the United Mine, cutting through an elvan course cost 80*l.* a fathom, and afterwards 120*l.* On the Continent an important district of this kind is worked by "fire-setting," a practice I have already mentioned as being very ancient, and sufficiently effective in particular districts—the Hartz, Norway and Sweden, and Hungary. In these regions the rock is close, dense, and of extreme hardness; the price of wood is very low, and being chiefly pine, a bright, clear, rapid flame is produced; the ventilation is sufficiently good to clear away the smoke and other products of combustion with great rapidity; the ores to be obtained are not injured by the action of fire, and the strata are such that there is no danger of establishing a permanent combustion (such as would take place in a coal pit, for instance), and thus endanger the whole mine. All these conditions must exist to make this system profitable. It is thus managed. Heaps of wood are piled up against the face of the working with great art and skill, so as to make the flame act upon the rock, and to secure a rapid draught. When all is ready the men are got out of the mine, excepting only those who are to light the fires. This is done with considerable rapidity, and in a short time all will be in full swing, and the whole presents a magnificent spectacle. As soon as the heat begins to operate explosions begin to occur, and the rock come away in large flakes. The firers, of course, retreat as early as possible, because the shaft becomes an immense furnace chimney, and the influx of air below being considerable, a splendid combustion is kept up till all the fuel is consumed. These fires are mostly lighted on Saturday, and by about Tuesday the workings have sufficiently cooled to allow the men to go down. They then find large portions of rock riven off from the main mass, and so cracked and fissured as to admit the pick and crowbar to be worked with effect. What is broken down will take two or three days to remove, and then preparations begin to be made for the next fire-setting. In one district, where the minerals to be dealt with are the harder varieties of quartz, such as hornstone, intermingled with sulphides of iron and other substances of extreme hardness, the levels are driven by means of fire-setting. Of course, in narrow work, 7 ft. high by 5 ft. wide, great care and skill are requisite, and the fire is applied in a sort of movable fire-place, with wrought-iron bars pushed up to the face, and the wood so laid as to make the flames play upon the portions of rock to be removed. These fire-places often require to be replenished with fuel two or three times, and the ultimate result is that when cool the ground is broken away with great facilities where it has not been absolutely dislodged by the heat. This system is adopted in the deep mines of Kongsberg, and the driving is accomplished with a saving of two-thirds of the expenses which would be incurred if gunpowder were used instead. The practice of fire-setting has been frequently carried out without much regard to the future safety of the mines, and there are no more fearful places to be seen than the vast cavities has created.

[The lecturer illustrated these works by numerous diagrams and drawings.]

LECTURE XXI.—Our four next lectures will be occupied in considering the different methods of breaking the ground and cutting a way through the rocks. A great deal of this ground is what is called "dead"—that is, it contains no mineral deposits which are useless, but it is often necessary to cut away to get at that which contains the valuable minerals. The metalliferous rocks are more or less of great hardness, and the various species of rocks naturally are classified, as we have seen, according to their hardness or softness. The first thing, therefore, which suggests itself to our notice is the various kinds of payment for different kinds of work. The working expenses of a mine are of the highest importance, and always require careful and economical management. Many mines cost from 200*l.* to 1000*l.* per month, a large portion of which is paid to the men as wages. The mining manager has, therefore, to see that he obtains as much work from the men as, under the circumstances in which the mine is placed, he could fairly expect. Work is paid for in different ways in different districts, and men working in narrow and difficult levels are paid better than when the workings are wide and easy. There are a great number of men whose occupations will be at the surface. Besides these there are also many others, who can scarcely be classed, as they do not work at any distinct occupation. It is, therefore, advisable to divide those men who can be classed, and pay them according to an arranged scale. In works of an extensive description there are a number of head officers, differing somewhat in titles and duties, in collieries and metalliferous mines. The following is the list of men employed at an extensive colliery and at a large metalliferous mine:—

COLLIERIES.	corresponds with	METALLIFEROUS MINES.
Chief viewer	corresponds with	Chief capt. & superintendent
Under viewer, resident on the spot	"	Resident captain.
Overmen and deputy overmen	"	Grass captains, in charge of the surface arrangements.
Fireman, who holds a most important charge, as he has to see if the mine is free from dangerous gases before the men go to work	"	Wastemen, who are sometimes needed in the fiery mines, whose duties are very similar to those of firemen in collieries.
Deputy-overmen	"	Pitmen, or shaftmen.
No equivalent	"	Timbermen, who are employed in putting up the supports to the roofs and sides of levels.
Hewers, holers, or pickmen, the actual miners who win the material	"	Tributemen and tubmen.
Putters and drivers	"	Trammers,
Hangers-on and on-setters	"	Fillers.
Trappers, or doorkeepers	"	Not needed.
At the surface—		
Banksmen	"	Landers.
Screeners	"	Dressers.

There are also smiths, carpenters, stokers, and enginemen employed both at collieries and metalliferous mines. At the office, near the shaft, there must be a clerk, and very often a paymaster. The head officers generally receive salaries, paid quarterly or yearly, but many of the petty officers are paid monthly, weekly, or even daily. If the wages are paid frequently it is a sort of stimulus to the men to keep working on. It must be remembered that in metalliferous mines especially we have to deal with men who have to work in remote and solitary places, where they, probably, cannot be visited more than once a day, and no supervision can be kept over them as to whether or not they are earning their wages. If these men were paid by the day, they would frequently show that they were not afraid of their work, by lying down to sleep beside it. It is obvious, therefore, that in such cases it is better to pay for the work done. In some neighbourheods the men are paid according to the number of holes they make in the rock of a certain depth, but it often happens that the miners make one hole do duty twice, by charging it in such a manner that it goes off like a gun, but produces no effect, beyond a loud report. This mode of payment is a good one, no doubt, in a stone quarry, where all the men can easily be seen and got at, but in a mine, where men are not supervised with so much facility, this plan is anything but satisfactory. As a general rule, it is better to pay by the quantity of work done.

In many mines it is customary to work the clock round, and this is done by dividing the men into three shifts, or cores, of eight hours each, one set of men being expected to work for eight hours every day. When the work is not urgent the men do not work at night, and are then divided into two sets. In the case, however, where the rock is extremely hard and difficult, and the ventilation is bad, it is not unusual to bring a greater number of men, divided into four shifts. It is of great importance that one shift of men should always be in readiness to relieve those at work at the expiration of their time. The eight-hours system is very general throughout Europe; it is a good one, and has an obvious advantage over the twelve-hours system, which exists in some places. No man could work for twelve hours with the same amount of vigour as he could for six or eight hours. Many of the men who do not work incessantly, as overmen, enginemen, fillers, and stokers, can easily work for twelve hours, as certain classes of work can be done for a longer time than others. In some exceptional cases the men are left to pay themselves. This occurs in Flintshire, where the miner makes a bargain to work the mine, and keeps a portion of the mineral as wages, the proprietors getting the rest. This is objectionable, because the men are, as it were, left to their own devises with respect to their mode of working, and frequently do considerable injury to the mine. As the men are anxious to get as much as possible, they merely extract the mineral, and allow the rubbish to accumulate in the levels, instead of removing it, many landowners, however, set their faces against this mode of letting mines to the workmen, by forbidding it in their leases. The usual mode of payment is that of "tutwork," which is so called from the German phrase "todt" work, or dead work of the mine. Men who have tutwork bargains in Yorkshire are called "dead men," and are paid so much per fathom or the yard; and in France by the metre. It is in driving excavations and sinking shafts, a work which is necessarily costly, because of the small space in which the men can work, or in driving an adit, that the work acquires this name. In metalliferous mines a great deal of ground must be gone through, whether it contains ore or not, and it must be paid for according to the length of ground the men get out in a certain time. And so in collieries the usual rule is the same in sinking the shafts and driving exploratory levels more or less in advance of each other. In collieries levels of this kind may be regarded as strictly preparatory to laying open the material as it is to be worked afterwards, and it is, therefore, desirable so to manage as to make it practicable to do away with tutwork. And this for several reasons: one is that, supposing the work is in a coal field, the mineral removed in driving a narrow preparatory drift is too small to be profitable for sale. In metalliferous mines the miners will frequently undertake, for a certain price, to remove small lodes, varying in size from 2 to 8 feet, entirely, and even in these cases bands of dead ground will sometimes be in the way, and have to be removed also. This system is not a good one, as the men are apt to mix the rubbish with the ore, if they are paid merely to remove a particular length of ground. In gold and tin veins great care is necessary to keep the ore separate from the rubbish. In metallic mines the judgment and experience of the manager and engineer are constantly being tried in determining as to what is the just and right amount as between man and master to pay for the work, and those who are placed in such positions will find the advantage of having previously acquired a knowledge of the use of implements, whether the work is done by the pick or by blasting. These bargains are made from month to month, as if a longer time passes without a revision of the terms, from the changes which occur in the nature of the ground, those terms may become unfair on the one side or the other. For instance, if the ground becomes much easier the men may "make wages," as it is called, too easily, and the money required for them may not be consistent with the proper economy of the mine; or they may idle away a great deal of time. It is unwise to pay the men too frequently; and, on the other hand, if they are not paid at reasonable intervals the wages accumulate, and the men will not work after pay-day until they have spent all their earnings. Miners, as a class, are not a provident set of men, being given to extravagance, and spending their money hastily. To pay wages once a fortnight is a good rule, but once a month is still better. The spendthrift habits of the men, who get rid of a month's wages in a few days, render what is called "subsistence money" necessary. This is money supplied to the men during the month to live on, and is, of course, subtracted from their wages at the regular pay-day. The various considerations which are to be taken into account in making bargains with the men may be enumerated as follows:—

1.—The size of the excavation, as it may be, larger or smaller will vary with the price paid.

2.—The hardness of the rock.

3.—Its jointiness and its cavernous character.

4.—Whether it is dry or wet, as it not unfrequently happens that the miner is obliged to work in water up to his knees, which is not only inconvenient and unhealthy, but makes progress very slow.

5.—Skill and the expenses of living in the district. The latter was found to be, in California and Australia a few years back, an important consideration, as the prices for food were very high and exceptional.

6.—The depth and ventilation of the mine.

7.—The condition of the mine, and the strength and skill of the workmen. The distance the men have to come from their dwellings must also be taken into consideration, as those who have far to come cannot be expected to do as much work as those who live close at hand.

8.—The distance there is to tram the material to bottom of the shaft.

It is usual in all mining districts for the company, or managers, to supply materials for working, such as gunpowder, candles, &c., all of which have to be repaid by the workmen; and this also must be considered when fixing the wages of the men. In Germany the mines are directly under the supervision of Government, and in Saxony there are mines which have been steadily worked for hundreds of years, and which are taken by the men, who bargain to cut a certain lode for a certain price. In Cornwall and Devon it is the custom to let out the work by a sort of public auction, which is a very fair plan. The men are made acquainted with the ground to be worked, and competition is invited, and thrown open, not only to those already employed, but to any other workmen who may wish to compete. The captain has, of course, visited the place beforehand, and made himself well acquainted with the nature of the ground to be worked. The men do the same, and then they assemble somewhere near, and the bidding commences. Perhaps 5*l.* per fathom may be offered, and so on until the agent thinks he has got a fair price, and the bargain is made. The very uncertainty which attends the work seems to give it an attraction in the eyes of the men. Thus a party of men may have bargained to do the work for 10*l.*, and after driving a little way may find the ground become so much softer that it might be advantageously worked for 7*l.* In such cases the men either take it quietly for the rest of their time, or work hard to make a large sum of money. On the other hand, the ground is also subject to go against them, and then they have to work vigorously, and are much pushed to "make wages," as a fair earning is called. They, however, go cheerfully on, trusting that the captain will have found that the ground is really so much worse than anticipated, and make it right in the next month by giving them some advantage. A good deal of the probability of "making wages" being thus in the workmen's own hands, they look narrowly, and with very great care, to the physical conditions presented by the mine, and consider all the chances likely to come into play during the time for which the bargain is made. It is often a good plan in sinking a shaft to let the men have it in a lump bargain, with the addition that if it is done before a certain time they will have a bonus, or if above that time a proportionate deduction. In another sort of bargain the payment is made according to the weight of the ground which is worked—a method suitable where all the mineral is useful, as in seams of coal; but in metalliferous mines, where a great quantity of material is useless, the system is not often applicable.

Where it can be fairly used it is customary to have weighing machines at the pits' mouth; and if the men are numerous, it is not unreasonable that they should appoint a check weigher, or "justice-man," to stand by and see that everything is fairly done. On the other hand, the man who weighs for the owner should be careful to see that the wagons are duly filled, and with proper coal, as the colliers are very fond of shovelling in a quantity of slack and dirt, which cause it to weigh heavier, but unmarketable. In metalliferous mines the system of "tributing" prevails in many districts, by which men are paid so much out of every pounds worth of ore they raise, and is often found advantageous. In cases where the vein is moderately rich the men will contract to turn out all the ore (say) for 10*s.*, 12*s.* 6*d.*, and 15*s.* in 1*l.*, and yet not make a profit, but if the miners should come upon what is called a "nest" of ore, to work which 2*s.* 6*d.* in 1*l.* would pay them, then they reap a rich harvest. This system forces the men to keep their eyes open as to every indication of ore which may present itself. I have known two or three men earn 70*l.* and 80*l.* in a very short period, and these "starts," as they are also termed, awaken the zeal of the men, and prevent them losing heart. Such runs of luck are fairly deserved and fairly won, and injures nobody. The men speculate upon these nests, and when they discover indications which seem to lead to riches they are apt to conceal their discovery, and so reap the benefit in the next month's bargain. Managers must also be on their guard against their complaints of the mine getting very poor, which are often only intended to mask concealments of this kind; and so by a little clay judiciously plastered on a promising spot, or by heaping up the rubbish, so as to conceal favourable appearances, the miners get the advantage. Although there are some disadvantages to this system, it is an admirable one in many cases. It is, however, necessary for the manager to be constantly looking over the ground over which the men have worked to see that it is perfectly done, and that the dimensions and direction of the workings are strictly maintained.

MORRIS TESTIMONIAL FUND.

The penultimate general meeting of the committee was held at Haxell's Exeter Hall Hotel, on Tuesday,

Prof. JAMES TENNANT, F.G.S., F.Z.S., in the chair.

The preliminaries were disposed of, and apologies offered by Mr. Henry Woodward and others for the absence of Sir Roderick I. Murchison, Bart. (the President), and two or three other members of the committee.

The CHAIRMAN, though regretting the absence of the President, could assure the meeting that it gave him infinite pleasure to occupy the chair at a meeting like the present—for determining the time and best mode of presenting a substantial testimonial to so old and valued a friend of his as Prof. Morris. He was glad to find that so large an amount had been already subscribed, and he had no doubt that as soon as a day was fixed as the last upon which subscriptions could be received many more names would be added.

Mr. WOODWARD, F.G.S., said that before any resolution was proposed he would mention that Mr. Prestwich and Mr. Noble were ready to add 50*l.* each to the list, upon the condition that the testimonial did not take the form of a useless, though expensive present, and that not more than two or three guineas should be expended for a written record of the testimonial having been presented.

Mr. MARSHALL HALL, J.P., thought the committee would agree unanimously with Mr. Prestwich that nothing useless should be presented. For his own part, he considered a purse, or its equivalent, the most sensible testimonial that could be given, as Prof. Morris could then purchase plate or not, at his discretion.

Mr. W. P. BEALE, F.G.S., concurred with Mr. Hall, and thought that if the honorary secretary would have a parchment written, stating the object of the testimonial, and followed by the names only of the subscribers, it would answer every purpose, and be well done by a law stationer very cheaply.

Dr. MURIE, Prosector Z.S., thought that the fund should be presented to Prof. Morris free of any restriction whatever; indeed, if the testimonial were not given handsomely it would lose all its value—especially in the case of the man to whom it was to be presented.

Mr. W. MILNES, F.G.S. (the treasurer), announced that the amount already at Messrs. Barclay and Co.'s was above 450*l.*, the only charge on the other side of the account being 7*d.* for collecting a Scotch draft—with the subscriptions of Mr. Prestwich, Mr. Noble, and others it would probably be about 600*l.*

The CHAIRMAN said that, as to the time of presenting the testimonial, he would suggest, as Feb. 19 was Prof. Morris's birthday, it would be well to fix that day for the presentation, if there were no objection.

The Rev. T. WILTSHIRE, M.A., V.P.G.S., remarked that it might be somewhat inconvenient to make it Feb. 19, as it was the day fixed for the Geological Society's annual meeting, but he thought they might consider it as presented on that day, although the actual presentation might be a little later. He concluded by moving "That the account be closed on Feb. 18, and that on Feb. 19 a cheque or deposit-receipt for the amount be handed to Prof. Morris." The written portion of the testimonial could be given either with the deposit-receipt or afterwards.—Mr. MARSHALL HALL seconded the resolution, which was carried unanimously.

It was further resolved, on the proposition of the SECRETARY, seconded by Dr. F. G. FINCH, "That a sub-committee, consisting of Mr. Prestwich, Mr. A. Tylor, and the treasurer, be requested to carry out the foregoing resolution."

Complimentary votes having been passed to the treasurer, &c., and to the Chairman for his conduct in the chair, the meeting separated.

ON GATHERINGS FROM A MINE BURROW.—Mr. J. H. Collins, F.G.S., read a paper at the Penzance Institute on this subject: He commenced by remarking upon the peculiar and distinguishing properties of the three minerals—quartz, felspar, and mica—present in every variety of granite; and mentioned the fact that large plates of mica, or Muscovy glass, had been used in the windows of Russian ships of war instead of glass, on account of its non-liability to fracture from the concussion produced by the firing of heavy guns. Mr. Collins described some changes in the constitution of the granite to the west and south of Carn Marth, which had been produced subsequently to its original formation. He stated that in many places the felspar, containing, perhaps, one per cent. of iron, eight or nine of potash, and no magnesia, had somehow been converted into chlorite, with about 20 per cent. of iron, as much magnesia, and no potash; and this again into an impure peroxide of iron, with, perhaps, 50 per cent. of iron, and neither potash nor magnesia. He observed that the whole series of changes might sometimes be found in specimens not larger than the hand; and further remarked upon the magnitude of these changes, extending as they do to millions of tons of rock. Mr. Collins then referred to the minerals occasionally present in the granites of Cornwall, especially schorl, topaz, pinite, beryl, and oxide of tin; and also to the joints which might be observed in any granite quarry, mentioning their great value to the quarryman, and their influence upon the coast scenery of Cornwall. He next referred to the killas rocks; the influence of different varieties of killas upon the productiveness of the lodes; the probable mode of formation of killas, and the metamorphic action to which it had been exposed since its deposition. He then proceeded to indicate some of the evidences of earthquake and volcanic agency exhibited by the lodes and cross-courses which traverse the killas, giving instances from Sir C. Lyell of recent earthquake action in Italy and Sicily. Mr. Collins then spoke of the many varities of minerals which the diligent student might expect to find on the burrows (more than 50 having been found in Dolcoath alone), and those peculiar to certain districts; mentioning especially the "chlorophane," from East Pool and Pedn-an-drea Mines; and the "leaf-copper," common at the United Mines; and referred to the turning over of old burrows, and modern utilisation of blends and mundic. He remarked that a real acquaintance with mineralogy could only be obtained by handling and experimenting upon the common varieties of minerals, and recommended those who wished to become mineralogists to learn to use the blow-pipe.

COAL MINING IN CHINA.—The principal coal-producing districts where this mineral is worked are three, in the province of Shangtung, but there are several other places where coal is known to exist, and where the mining is prohibited. The largest coal mines are in the Lan-fu-ho valley, which runs north and south, and has coal pits on either side. Both bituminous and anthracite coal are extracted. Ten pits are now working near Po-shan-hsien. Gangs of 60 men work night and day in the pits, which are from 50 to 70 ft. deep, and then branch off into tunnels of 1000 ft. in length, supported by rough beams of wood. The coal seam is from 6 to 15 ft. thick. The men work below with picks, and the coal is brought up in baskets by means of a windlass worked by 10 men. I saw some very large pieces drawn up, one piece filled the basket of itself. The water is drained off below, the pits being well up on the hill side. A deep well is sunk at the foot and a drain made from the coal seam, down which the water runs to the well, when it is drawn up in skin buckets by a windlass. The Government tax on these coal mines is very moderate; but the local squeezes exorbitant. The Wei-hsien coal fields are situated in an undulating plain about 20 li south-south-west of that city, with hills to the south and west six miles off. There are a great number of pits here, but only ten at present worked. The pits are from 15 ft. to 30 ft. deep, and the miners work on until the water rises over the seam. This they keep under as long as possible, bringing it up in large skin buckets, containing about three gallons, by means of a huge windlass; but when it gets beyond them they desert the pit, and go to another. Thus it is probable that they miss the finest quality of coal. A few miles from Wei-hsein numerous coal-pits are in active operation, Wei-hsein using coal entirely for fuel. The shafts are sunk in the plain to a depth of 100 ft. or 120 ft., and galleries of considerable extent run out from them, new shafts being sunk when ventilation appears desirable—the coal underlying the whole country. The miners are most friendly disposed, and one who had visited Shanghae was most anxious to learn at what cost he could procure a foreign pumping apparatus, apparently seeing no difficulty in putting it in use if procurable within the limits of his purse. Until, however, a good road be made from Yentai to Wei-hsein, the development of the mines, even if a better quality of coal exist, would profit little.—*Journal of Applied Science.*

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending Jan. 23 was 9087*l.* 12*s.* 9*d.*

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